

# Working Group on Ecosystem Services Implementation Plan 2023-2026

## Purpose

### Objectives

Over the last decades, work on ecosystem services has focused strongly on describing different types of services from nature, quantifying their temporal and spatial variation, and recognizing the numerous trade-offs that emerge when considering multiple services. Although ecosystem service indicators do exist, there are large informational, conceptual, and methodological biases that need to be addressed before we can make reliable estimates of where and how ecosystem services are changing. The GEO BON Working Group on Ecosystem Services (ESWG) aims to expand, integrate, standardize, and harmonize the ways we understand, measure, and predict ecosystem services change. The ESWG will contribute to evidence-based science that helps society mitigate biodiversity loss and adapt to changes in ecosystem services affecting people's quality of life. This requires improved understanding of the linkages between biodiversity and ecosystem functioning, whilst considering all relevant social dimensions. To ensure the sustainable use and long-term supply of ecosystem services, addressing the dynamics within social-ecological systems is fundamental. This is essential to develop policies and practices across multiple stakeholder groups, including for instance, governments, businesses, indigenous people, and society. In broad terms, the main objectives of the ESWG are to:

1. Define and expand the conceptual basis of Essential Ecosystem Services Variables (EESVs), and their links with Essential Biodiversity Variables (EBVs) as well as with social, cultural, economic and knowledge-based systems.
2. Operationalize and promote the use of Essential Ecosystem Service Variables (EESVs) in monitoring schemes from local to global scales.
3. Engage and promote synergies with other initiatives, projects, and networks focused on ecosystem services, such as in business, government, civil society, education, and research.

By doing so, the ESWG will contribute to advancing a scalable observation and monitoring system that enables or facilitates status and trend assessments of multiple ecosystem services across temporal and spatial scales. This is aligned with GEO BON's general mission to address the needs of individual countries, conventions, and treaties, especially the Convention on Biological Diversity (CBD), as well as the goals of wider frameworks on ecosystem services (such as the SEEA-EA: System of Environmental-Economic Accounting-Ecosystem Accounting).

### Short description

Biodiversity and ecosystem changes are having consequences on the services and benefits that ecosystems contribute to people's quality of life. The GEO BON Ecosystem Services Working Group (ESWG) aims to detect, understand, and predict patterns of ecosystem service change by monitoring their trends. Such scope requires a better understanding of the links between biodiversity and ecosystem functioning, as well as going beyond biophysical considerations on the quantification of natural systems, in order to include multiple trade-offs, scales, and social dimensions, and hence to

support appropriate policy and practices across multiple stakeholders, from governments and businesses to the civil society. To do so, the ESWG embraces complementary visions from different disciplines and state-of-the art technologies to observe, identify, describe, and explore trends in social-ecological systems and ecosystem services. This inevitably requires the definition of ecosystem services' dimensions, their variables, and indicators, as well as advancing how ecosystem services can be feasibly measured across different habitats, biomes, and regions. To do so, the ESWG seeks to strengthen collaboration and participatory processes with national, regional, and global business and governmental actors, who, through their policies and actions, can influence institutional structures, management practices and human behavior, while continuing its academic and scientific foundations.

### Why is the group needed?

Most monitoring and reporting activities focus on biodiversity, with ecosystem services mentioned alongside these. The majority of existing frameworks and reports are often less specific about measuring and monitoring ecosystem services, and even less clear about the indicators and methods to use. This is particularly true for the linkages between biodiversity, ecosystem services, and their social dimensions (e.g., socio-cultural values and knowledge systems), all of them fundamental for developing appropriate policies and practices across multiple stakeholders in line with the CBD. A coordinated working group on ecosystem services is needed to expand, integrate, standardize, and harmonize data, concepts, and methodologies over the several dimensions of ecosystem services. Most importantly, the ESWG is needed to help define options for effective decision-making based on the scientific knowledge produced over the last 15 years of GEO BON and to guide real world applications to safeguard ecosystem services and people's well-being.

### How is this group unique? Are you aware of other projects or networks at a global or regional scale (both in GEO/GEO BON and externally) that provide similar products or services? Please describe.

The GEO BON ESWG exists to bring together academics and practitioners primarily focused on expanding, integrating, standardizing, and harmonizing indicators, data, and methods to understand, measure, and predict change in ecosystem services (ES) and people's wellbeing. By striving to establish a structured set of indicators that encompass all aspects of ES delivery from the ecosystems' capacity to interactions with humans and society, linking with appropriate data and methods through which ES can be observed and monitored, the ESWG brings a distinct, yet complementary, mission from other networks operating at the global and regional scales, such as: (i) the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) focused on the synthesis of knowledge to assist in the science-policy interface for the conservation and sustainable use of nature, and (ii) the working groups within the ESP - Ecosystem Services Partnership (e.g. TWG 1 – ES Assessment frameworks & Typologies, TWG 3 – ES Indicators or TWG 20 – Equity in Ecosystem Services research), dedicated to partnership events that promote the application of ecosystem services for nature conservation, restoration and sustainable management. By specifically focusing on ES, the ESWG also distinguishes itself from other networks addressing overall sustainability (Future Earth, One Health) and biodiversity (Alter-Net - A Long-Term Biodiversity, Ecosystem, and Awareness Research Network, eBioAtlas, LifeWatch Eric, The Biodiversity Digital Twin, ILTER and eILTER), or specific taxonomic groups (IUCN Wild Bee Specialist Group), regions/countries (e.g., regional and national-level biodiversity centers, ResNet

Canada), and ecosystem realms, such as marine (GOOS - Global Ocean Observing System, Deep Ocean Stewardship Initiative), freshwater (Alliance for Freshwater Life), mountain (The Mountain Research Initiative, GEO Mountains, FAO Mountain Partnership), and soil (NETSOB - INTERNATIONAL NETWORK ON SOIL BIODIVERSITY). Due to its transversal scope and methods addressing the different dimensions of ecosystem services across biomes and taxonomic groups, the ESWG further links to other GEO and GEO BON groups and initiatives, including the EO4EA - Earth Observation for Ecosystem Accounting, the Remote Sensing WG, the Species populations WG, the Species traits WG, the Community composition WG, the Ecosystem Function WG, the Soil BON, the Marine Biodiversity Observation Network, or the Freshwater Biodiversity Observation Network. Finally, ESWG outputs also complement those from other systems, standards, and projects taking place at the global (e.g. the UN's SEEA for Ecosystem Accounting) and regional, though EU/European-biased, levels (e.g. MOVE-ON, SELINA, Eudaphobase, and Bioagora). Particularly pertinent may be ecosystem accounting, as the popularity of the System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA-EA) rises. The SEEA-EA has already developed a set of standard indicators for ecosystem services in ecosystem accounting, and the ESWG will need to address these in connection to Essential Ecosystem Services Variables (EESVs).

### Who are the users?

The ESWG contributes, directly or indirectly, to a multitude of end-users, namely:

- Governmental and intergovernmental entities, from local to global scales
- Land/sea managers and decision-makers
- Research infrastructure, including within and outside academia
- Ecosystem services networks and partnerships
- NGOs and citizens
- Local and Indigenous communities
- Educational institutions, including university systems but also other educational levels
- Business institutions, including those that impact and depend on ES and biodiversity, such as finance and insurance institutions
- Funding agencies
- Multi-stakeholder platforms and initiatives

### Outputs

For the period 2023-2026, the Ecosystem Services Working group will be dedicated to developing different outputs to achieve three key and complementary goals:

1. *Conceptualization* - Define and expand the conceptual basis of Essential Ecosystem Services Variables (EESVs), and their links with Essential Biodiversity Variables (EBVs) and social, cultural, and knowledge-based systems.
2. *Implementation* - Operationalize and promote the use of Essential Ecosystem Service Variables (EESVs) in monitoring schemes from local to global scales.
3. *Engagement* - Create and promote synergies with other initiatives, projects, and networks focused on ecosystem services, such as in business, governments, civil society, and research.

The work plan for the next implementation period consists of three major components, all of which are interconnected (Figure 1). For each of those components, priority activities and outputs resulting from interactions among the members of the WG are expected. Other activities and outputs may nonetheless be followed during the strategic plan as part of the collaboration between WG members and other ongoing initiatives within GEO BON (and beyond).

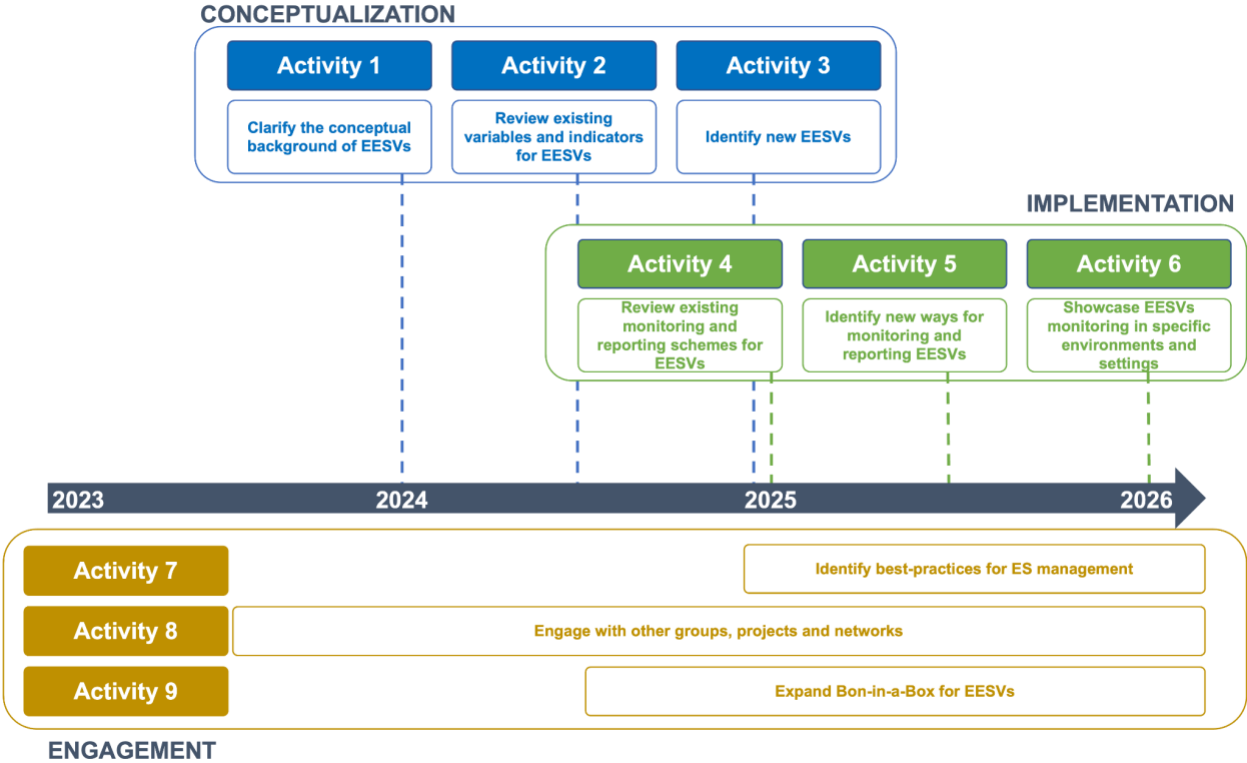


Figure 1 - Overview of the different activities of the ESWG implementation plan for 2023-2026.

**1. CONCEPTUALIZATION**

*Goal: Define and expand the conceptual basis of Essential Ecosystem Services Variables (EESVs), through links between Essential Biodiversity Variables (EBVs) as well as with social, cultural, economic and knowledge-based systems.*

*Leading coordinator: Agnes Vari*

<b>Activity 1</b>	<b>Clarify the conceptual background of EESVs</b>
Lead(s)	Flavio Affinito, Agnes Vari, Sundar, Pradeep Mehta

Activity 1	Clarify the conceptual background of EESVs
Team	Frank Muller Karger, Franco Leandro de Souza, Carla Atkinson, Ken Bagstad, Max Finlayson, Michael Orr, Giorgio Matteucci, Adamescu Cristian Mihai, Ana Carolina Mazzuco, María Vallejos, Javier Cabello, Katherine von Stackelberg, Flavio Affinito, Ana Stritih, Carolina Puerta Pinero, Eulogio Soto, Dula Duguma, Vânia Proença, Sundar, Jamie Kass, Anton Van de Putte, Rajasekaran Murugan, Jorge Ari Noriega, Domingo Alcaraz-Segura, Pradeep Mehta, Joana Vicente, Lluís Brotons, Nicolas Moity, Zulfiqar Saqib, Antje Kammermeier, Agnes Vari, Eren Turak, Leticia Campodónico, Angela Lomba, Zacchaeus Compson, Emily Rubidge, George Brown, Simone Mereu, Dominique Pelletier, Artur Gi, Nuria Pistón, Ana Sofía Vazl, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims at clarifying the concepts associated with EESVs, by exploring in more detail what EESVs should cover or not, including the identification of additional EESVs (expected in Activities 2 and 3) based on existing indicators and gaps, that are linked with both the ecological (e.g. EBVs, ecosystem functioning) and the social dimensions (e.g. anthropogenic contribution, relational and instrumental values) of ecosystem services.
Main output	Conceptual paper
Expected date of completion	End of 2023 - Beginning of 2024

Activity 2	Review existing variables and indicators for EESVs
Lead(s)	Agnes Vari, Giorgio Matteucci, Anton Van de Putte, Zulfiqar Saqib, Antje Kammermeier, Leticia Campodónico
Team	Frank Muller Karger, Flavio Affinito, Franco Leandro de Souza, Ken Bagstad, Adamescu Cristian Mihai, María Vallejos, Javier Cabello, Bruno Locatelli, Katherine von Stackelberg, Carolina Puerta Pinero, Eulogio Soto, Elena Interesova, Sundar, Jamie Kass, Masoud Minaei, Domingo Alcaraz-Segura, Pradeep Mehta, Joana Vicente, Jorge Ari Noriega, Laurence Jones, Zacchaeus Compson, Emily Rubidge, Artur Gil, Nuria Pistón, Ana Sofia Vaz, Dominique Pelletier, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims at reviewing existing data, variables and indicators from other systems, commitments or reporting systems on natural capital and ecosystem services (such as EBVs, economic accounting, anthropogenic use), that can be used to inform and measure EESVs (both ecological and human dimensions).
Main output	Dataset of variables with existing (monitored/used) indicators
Expected date of completion	Mid 2024

Activity 3	Identify new EESVs
Lead(s)	Giorgio Matteucci, Anton Van de Putte, Zulfiqar Saqib, Antje Kammermeier, Leticia Campodónico, Agnes Vari
Team	Frank Muller Karger, Flavio Affinito, Franco Leandro de Souza, Ken Bagstad, Adamescu Cristian Mihai, María Vallejos, Javier Cabello, Bruno Locatelli, Katherine von Stackelberg, Carolina Puerta Pinero, Eulogio Soto, Elena Interesova, Sundar, Jamie Kass, Masoud Minaei ,Domingo Alcaraz-Segura, Pradeep Mehta, Joana Vicente, Jorge Ari Noriega, Laurence Jones, Zacchaeus Compson, Emily Rubidge, Artur Gil, Nuria Pistón, Ana Sofia Vaz, Dominique Pelletier, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims at critically identifying which priority gaps need to be addressed to inform and measure existing and additional EESVs, and how they can be tackled, including the identification of new EESVs and the required data, variables, and indicators.
Main output	Dataset of new EESVs indicators
Expected date of completion	End of 2024 - Beginning of 2025

## 2. IMPLEMENTATION

*Goal: Operationalize the use of Essential Ecosystem Service Variables (EESVs) through monitoring schemes at multiple scales.*

*Leading coordinator: Flavio Affinito*

Activity 4	Review existing monitoring and reporting schemes for EESVs
Lead(s)	Agnes Vari, Sundar, Anton Van de Putte, Pradeep Mehta
Team	Frank Muller Karger, Franco Leandro de Souza, Flavio Affinito, Carla Atkinson, Artur Gil, Ken Bagstad, Max Finlayson, Giorgio Matteucci, Christophe Piscart, Adamescu Cristian Mihai, Ana Carolina Mazzuco, Javier Cabello, Katherine von Stackelberg, Flavio Affinito, Ana Stritih, Carolina Puerta Pinero, Eulogio soto, Dula Duguma, Vânia Proença, Elena Interesova, Sundar, Jamie Kass, Anton Van de Putte, Domingo Alcaraz-Segura, Joana Vicente, Lluís Brotons, Nicolas Moity, Zulfiqar Saqib, Antje Kammermeier, Eren Turak, Leticia Campodónico, Emily

	Rubidge, Dominique Pelletier, Artur Gil, Angela Lomba, Zacchaeus Compson, George Brown, Michael Orr, Bruno Locatelli, Masoud Minaei, Pradeep Mehta, Ana Sofia Vaz, Nuria Pistón, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims at checking monitoring, accounting, and reporting schemes (including governmental and business initiatives and commitments) dealing with ecosystem services indicators and variables that can be linked with already existing and new EESVs at their appropriate spatial and temporal scales.
Main output	Report with a combined "operable" monitoring scheme for multiple EESV classes and ES items, across multiple scales
Expecting date of completion	End of 2024 - Beginning of 2025

<b>Activity 5</b>	<b>Identify new ways for monitoring and reporting EESVs</b>
Lead(s)	Zacchaeus Compson, Pradeep Mehta
Team	Frank Muller Karger, Carla Atkinson, Artur Gil, Ken Bagstad, Max Finlayson, Giorgio Matteucci, Christophe Piscart, Adamescu Cristian Mihai, Ana Carolina Mazzuco, Javier Cabello, Katherine von Stackelberg, Flavio Affinito, Ana Stritih, Carolina Puerta Pinero, Eulogio Soto, Dula Duguma, Vânia Proença, Elena Interesova, Sundar, Jamie Kass, Anton Van de Putte, Domingo Alcaraz-Segura, Joana Vicente, Lluís Brotons, Nicolas Moity, Zulfiqar Saqib, Antje Kammermeier, Agnes Vari, Eren Turak, Leticia Campodónico, Emily Rubidge, Dominique Pelletier, Jorge Ari Noriega, Ana Sofia Vaz, Nuria Pistón, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims to identify novel ways to monitor (and report on) ecosystem services, using new technologies (eDNA, citizen science, social media, remote sensing) to address existing and new EESVs.
Main output	Guidelines for new monitoring methods/technologies
Expecting date of completion	Mid 2025

<b>Activity 6</b>	<b>Showcase EESVs monitoring in specific environments and settings</b>
Lead(s)	Flavio Affinito, Sundar, Anton Van de Putte, Pradeep Mehta, Agnes Vari
Team	Frank Muller Karger, Franco Leandro de Souza, Carla Atkinson, Artur Gil, Ken Bagstad, Max Finlayson, Giorgio Matteucci, Christophe Piscart, Adamescu Cristian



	Mihai, Ana Carolina Mazzuco, Javier Cabello, Katherine von Stackelberg, Flavio Affinito, Ana Stritih, Carolina Puerta Pinero, Eulogio soto, Dula Duguma, Vânia Proença, Elena Interesova, Sundar, Jamie Kass, Anton Van de Putte, Domingo Alcaraz-Segura, Joana Vicente, Lluís Brotons, Nicolas Moity, Zulfiqar Saqib, Antje Kammermeier, Eren Turak, Leticia Campodónico, Emily Rubidge, Dominique Pelletier, Artur Gil, Angela Lomba, Zacchaeus Compson, George Brown, Michael Orr, Sofia Costa, Masoud Minaei, Laurence Jones, Nuria Pistón, Dominique Pelletier, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims to illustrate and evaluate the operationalization of EESVs and indicators, through a set of joint application cases in specific environments and settings such as urban systems, arid and semi-arid regions, or the tropics (among others to be defined).
Main output	Paper or report with illustrative application cases on EESVs implementation
Expecting date of completion	End of 2025 – Beginning of 2026

### 3. ENGAGEMENT

*Goal:* Create and promote synergies with other initiatives, projects, and networks focused on ecosystem services, such as in business, governments, civil society, education and research.

*Leading coordinator:* Ana Sofia Vaz

Activity 7	Identify best-practices for ES management
Lead(s)	Angela Lomba, Flavio Affinito, Joana Vicente Sundar, Pradeep Mehta
Team	Frank Muller Karger, Carla Atkinson, Artur Gil, Ken Bagstad, Michael Orr, Giorgio Matteucci, Christophe, Piscart, Adamescu Cristian Mihai, Javier Cabello, Katherine von Stackelberg, Flavio Affinito, Carolina Puerta Pinero, Eulogio soto, Sofia Costa, Dula Duguma, Vânia Proença, Elena Interesova, Sundar, Anton Van de Putte, Rajasekaran Murugan, Jorge Ari Noriega, Joana Vicente, Zulfiqar Saqib, Antje Kammermeier, Eren Turak, Leticia Campodónico, Angela Lomba, Zacchaeus Compson, George Brown, Simone Mereu, Dominique Pelletier, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims to identify best-practices that promote ecosystem services management and their resilience, across ecosystem types and scales, while setting up orientations for measuring such practices through EESVs.

Main output	Best-practice guide
Expecting date of completion	End of 2025 – Beginning of 2026

Activity 8	Engage with other groups, projects and networks
Lead(s)	Ana Sofia Vaz, Nuria Pistón, Giorgio Matteucci, Flavio Affinito, Adamescu Cristian Mihai, Zulfiqar Saqib, Antje Kammermeier, Angela Lomba
Team	Frank Muller Karger, Carla Atkinson, Ken Bagstad, Michael Orr, Giorgio Matteucci, Adamescu Cristian Mihai, Ana Carolina Mazzuco Katherine von Stackelberg, Flavio Affinito, Carolina Puerta Pinero, Eulogio soto, Vânia Proença, Elena Interesova, Sundar, Jamie Kass, Masoud Minaei, Rajasekaran Murugan, Domingo Alcaraz-Segura, Pradeep Mehta, Joana Vicente, Lluís Brotons, Zulfiqar Saqib, Antje Kammermeier, Eren Turak, Leticia Campodónico, Angela Lomba, Zacchaeus Compson, Artur Gil, Agnes Vari, Dominique Pelletier, Gabriel Barros Gonçalves de Souza
Description & end-users	This activity aims to organize a series of initiatives (e.g. webinars, conference participation) with governmental, research and business networks and groups focused on ecosystem services, in order to account for different sectors needs and visions on EESVs as well as to promote EESVs application.
Main output	Different engagement initiatives, including participation in the GEO BON conference with a specific session of ES and the organization of webinars (see a preliminary list of topics below)
Expecting date of completion	Throughout the implementation period

### Webinars developed and expected

TOPIC OF THE SUGGESTED WEBINAR	ES WG MEMBER	WHEN?
<b>Methodological advances and opportunities for ecosystem services</b>		
Opportunities of eDNA in biodiversity and ecosystem services	Karen Dyson Zacchaeus Compson Paul Henning Krogh João Silva Rodrigues	Feb 2023
Using species distribution models for ecosystem service prediction	Jamie Kass	Late 2023
Using social media data and artificial intelligence in	Ana Sofia Cardoso	Late 2023

ecosystem services assessment		
<b>Ecosystem services in marine and freshwater systems</b>		
Marine ecosystem services: measurement, standards, and accounting	Frank Muller Karger Dominique Pelletier	TBD
Vulnerability of coastal wetland ecosystem services to climate change	Max Finlayson	TBD
Freshwater and biodiversity conservation	Sundar Gunasekaran	TBD
<b>Ecosystem services in terrestrial systems</b>		
Ecosystem Services in forests and forestry: status, conflicts, challenges	Giorgio Matteucci	TBD
Role of land degradation on agricultural ecosystem services	Zulfiqar Saqib	Last quarter of 2023
Soil EBVs and their linkages with ecosystem services	George Brown (in collaboration with SoilBON: Carlos Guerra, Nico Eisenhauer)	TBD
<b>Ecosystem services in the urban realm</b>		
Ecosystem services in the urban realm	Franco Leandro de Souza	TBD
<b>Ecosystem services in governance and decision making</b>		
Nature positive decision making	Katherine von Stackelberg	
Inequalities in the access of ecosystem services: poverty traps generated by natural resources degradation and decrease in the provision of ecosystem services	María Vallejos	TBD
<b>Ecosystem services in other initiatives, networks and systems</b>		
Interoperability, synergies with System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA-EA)	Ken Bagstad	TBD
Contributions of European Research infrastructures in ecosystem services assessment: eLTER, Lifewatch, ICOS in Europe	Adamescu Cristian Mihai	TBD
<b>Other webinars to present specific publications or events of worth to the group</b>		
Monitoring ecosystem services with Essential Ecosystem Service Variables – paper presentation	Flavio Affinito	Mid 2023
Science for evidence-based and sustainable decisions about natural capital – project presentation	To be invited	Late 2023
Ecosystem services assessment in Amazon mangroves –	Ana Carolina Mazzuco	Late 2024

project presentation		
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Activity 9	Expand Bon-in-a-Box for EESVs
Lead(s)	Nuria Pistón, Ana Sofia Vaz, Anton Van de Putte
Team	Frank Muller Karger, Carla Atkinson, Ken Bagstad, Flavio Affinito, Michael Orr, Giorgio Matteucci, Adamescu Cristian Mihai, Ana Carolina Mazzuco, Katherine von Stackelberg, Flavio Affinito, Carolina Puerta Pinero, Eulogio soto, Vânia Proença, Elena Interesova, Sundar, Jamie Kass, Masoud Minaei, Rajasekaran Murugan, Domingo Alcaraz-Segura, Pradeep Mehta, Joana Vicente, Lluís Brotons, Zulfiqar Saqib, Antje Kammermeier, Eren Turak, Leticia Campodónico, Angela Lomba, Zacchaeus Compson, Artur Gil, Gabriel Barros Gonçalves de Souza
Description & end-users	Can an EESVs database be developed (in support of a Bon-in-a-Box and GBioS)? Which meta-data may be necessary to report for ES products to support transparency and replicability?
Main output	Integration of previous outcomes on EESVs into the Bon in a Box platform
Expecting date of completion	2026

Does the Ecosystem Services group have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?

Yes, please see the table below for further details on the list of products/services.

Type of product/service	Responsible ESWG member	Access
Annual Land Use-Land Cover (LULC) maps for the Pampa Biome	María Vallejos	<a href="https://pampa.mapbiomas.org/">https://pampa.mapbiomas.org/</a>
Deforestation monitoring in the dry forests of the Southamerican Chaco	María Vallejos	<a href="http://monitoreodesmonte.com.ar/">http://monitoreodesmonte.com.ar/</a>
City Explorer Toolkit (in development) enabling decision making on urban GI	Laurence Jones	NA

Data platforms (The Arid Iberian South East LTSER Platform), Communication channels (XVI Congreso Nacional de la AEET: “Ecología en una biosfera humanizada”, October 2023).	Javier Cabello	<a href="https://deims.org/889b159a-8b58-4685-9418-73ee70388799">https://deims.org/889b159a-8b58-4685-9418-73ee70388799</a>
Ecosystem services data analysis packages	Ana Carolina Mazzuco	NA
Existing data/models hosted on the ARIES network and specific platforms (e.g., ARIES for SEEA)	Ken Bagstad	NA
Improving water quality in the Danube River and its tributaries by integrative floodplain management based on Ecosystem Services	Adamescu Cristian Mihai	<a href="https://www.interreg-danube.eu/uploads/media/approved_project_output/0001/54/bdd66e10e836ce593e8d13dee05c7dc5cd0a6c66.pdf">https://www.interreg-danube.eu/uploads/media/approved_project_output/0001/54/bdd66e10e836ce593e8d13dee05c7dc5cd0a6c66.pdf</a>
Indicators to track specific ecosystem or population status; websites with indicators; groups focusing on indicators for marine protected areas	Frank Muller Karger	NA
Land degradation data and maps along with plant-based solution for marginal lands	Zulfiqar Saqib	Available in reports and specific webportal is in development for online availability
Web-platform with multiple free products available relating ecosystem services with invasive alien species	Joana Vicente	In development (expected to be available by the end of 2023)
Operationalising digital twin - remote sensing & predictive models	Katherine von Stackelberg	NA
Programming toolboxes and interactive apps for species distribution modeling	Jamie Kass	<a href="https://wallaceecomod.github.io/">https://wallaceecomod.github.io/</a> <a href="https://jamiemkass.github.io/ENMeval/">https://jamiemkass.github.io/ENMeval/</a>
Urban burns in vacant lots affecting biodiversity; biodiversity map of Brazilian cities	Franco Leandro de Souza	NA
Biodiversity data and model outputs (predictive spatial models on biomass, fish diversity) together with Fisheries and Oceans Canada	Emily Rubidge	NA

Dataset of soil fertility (mainly chemical analyses) data associated with soil fauna populations that can be used to assess the roles of soil biota in delivery of ecosystem services such as soil water holding capacity, soil erosion control, nutrient cycling, biological control of pests or plant production.	George Brown	NA
Mangrove ecosystem cover and temporal change in the Galapagos. First economical valuation of mangrove ES (tourism, fishing, carbon sequestration) in the Galapagos	Nicolas Moity	NA

Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Ecosystem Services group (for example, policy decisions taken, behaviour changes by users, risks mitigated)?

- Input for the Global Biodiversity Framework - GEO BON provided scientific advice and support to the ongoing negotiations of the post-2020 global biodiversity framework held by Parties to the UN Convention on Biological Diversity
- Different members of the ES WG took an active role not only in writing these reports and policy briefs, but also in the negotiations with the parties. Nature Restoration Law (EU) and Climate Law (EU)
- Sierra Nevada National Park managers (Southern Spain) have formally modified the management plan to consider ecosystem services, based on the scientific evidence provided by the ES WG to the target region

**Structure and governance**

Describe the structure of your group and the roles of key leadership positions?

The Ecosystem Services working group general coordination (Ana Sofia Vaz and Nuria Pistón) will involve communication with the secretariat, organizing working group activities, motivating engagement within and outside the working group, ensuring alignment between the working group and GEO BON strategic plans, and giving support to ensure the good development of expected activities, in direct communication with the coordinators/leaders of each activity. The activity coordinators/leaders (Agnes Vari, Flavio Affinito, Ana Sofia Vaz) will be responsible for the development of the different expected outputs/products, by following up on the different topics to address in direct communication with the output leaders. The output leaders will be responsible for coordinating the good development of the expected outputs in direct communication with the contributing members. Additional support by some group members (Jamie Kass) is also expected to allow communication interactions within the group.

### Is there a steering committee or other governance bodies that advise the group but are not involved in day-to-day management?

The ES working group does not have a steering committee or other like to advise the group, but such would be beneficial. We may count with the help from the secretariat to help on identifying senior advisors who will be available to advise on the general coordination, but not expected to be involved in the direct management and development of activities.

### Describe the mechanisms for coordination, support, and communication of your group?

For general issues regarding the working group, the primary source of communication will be the GEO BON mailing list of people registered in the Ecosystem Services working group. For specific issues (e.g. specific development of outputs, direct participation in this document), the communication will be done through the emails of those people more directly involved. Different online meetings are expected to occur: 1 - a meeting twice a month between the general coordinators; 2 - a meeting every six months with the whole working group; 3 - a meeting each three months with the activity coordinators; 4 - periodic meetings with the output coordinators, depending on the timing of the output and needs. Other means of communication are also expected to be promoted, including through a common online group platform (Google Groups) for close interaction among the most active group members, and a database repository for sharing literature and other relevant documents or information.

### What methods can be used by the group to monitor its effectiveness?

Reporting on the output development level in each meeting, for instance through a SWOT analysis, and adjustment of the different tasks and people if and whenever needed.

### Was there any review (internal/external) of previous Implementation Plans?

No, but see below on our expectation on how to monitor the effectiveness of the new proposed plan.

## Science and technology

### Brief description of the methods/technology used by your group to produce its (actual or planned) outputs

The Ecosystem Services Working group will be dedicated to developing different outputs to meet its goals: (1) *Conceptualization* - Define and expand the conceptual basis of Essential Ecosystem Services Variables (EESVs), and their links with Essential Biodiversity Variables (EBVs) and social, cultural, and knowledge-based systems. (2) *Implementation* - Operationalize and promote the use of Essential Ecosystem Service Variables (EESVs) in monitoring schemes from local to global scales. (3) *Engagement* - Create and promote synergies with other initiatives, projects, and networks focused on ecosystem services, such as in business, governments, civil society, education and research. Such will require conducting at least nine different activities, each of them with their specific methodological and technological procedures. Specifically, activities pertaining to the conceptualization goal will mostly use methods from research synthesis (both evidence-based review and critical state-of-the art approaches).

Activities focused on the implementation goal will also make use of research synthesis, while gathering, organizing and summarizing datasets pertaining to relevant and complementary indicators and variables for the assessment of ecosystem services, and illustrate their application by means of specific case studies using modelling, remote-sensing and other analytical approaches. Finally, activities associated to engagement, will be more focused on interaction ways within GEO BON the community and beyond. The WG is expected to have outputs which are more scientific-based (such as conceptual papers, research papers), to be disseminated in scientific journals, and also more technical documents (like guidelines, datasets, and reports) which can be made available to the general community and/or integrated into wider products/initiates, including the BON-in-a Box.

**Are there any significant scientific or technical challenges that need to be resolved by 2026? Describe these challenges and the steps being taken to solve them.**

*Key scientific challenges - to be addressed through the development of outputs:*

- Mainstream and operationalize the use of EESVs in monitoring, by harmonising and standardizing the plethora of ecosystem services initiatives, data, and methods through tools, guidelines, practices, and workflows that improve interoperability across scales, including devising protocols that facilitate harmonised data collection (from biodiversity to ecosystem function and services) to achieve greater use of local data for benchmarking and validation of regional and global ES data products.
- Continuing efforts to link and integrate the multiple sources of information and tackle data needs, by including other technologies and approaches (e.g. eDNA, social media), wider topics (marine, soil, urban), and identifying essential metrics for ecosystem services that capture and monitor human dimensions (including values and knowledge systems) and their links with biodiversity and the biophysical dimension (including ecosystem attributes, functions/processes)
- Expand and clarify the conceptual basis and utility of ecosystem services, including the connection with EBVs and the way the notion of ES is applied and framed in wider frameworks, such as environmental-economic accounting, nature's contributions to people, social-ecological-technological systems, or ecological redundancy, as well as among various stakeholders (particularly land users/managers and decision makers)
- Engage with other initiatives and projects with special emphasis on the Ecosystem Services Partnership and Capitals Coalition, but also wider networks (IPBES, SDG, UN SEEA EA).
- It will further contribute to BON-in-a-Box, in how to connect variables and metrics with wider initiatives (such as the SEEA), and in connection with BONs and other WGs. Share information from parallel initiatives and co-organize webinars, joint meetings, questionnaire-based surveys (among others) to understand the needs of different sectors.

*Key technical challenges:*

- The need to share relevant information within the group, including literature of interest via a common repository (e.g. Zotero - free, private and no restrictions of people), as well as opportunities, doubts, questions, through a dynamic mailing list or another communication channel (e.g. forum)



- Create an environment or even task forces to seek financial support to leverage group initiatives: project proposals, funding, etc
- Connect and work together with other users, including those from other WGs, BONs and GEO BON initiatives, in order to agree on priority observations and standards, either through work sessions, webinars, conferences, symposia, social media, etc.
- How to get a platform to make the scientific evidence available to decision-makers (BON-in-a-Box and/or in connection to other infra-structure or literacy-based initiatives)

## Other

Please indicate any GEO and GEO BON activities outside your group with which you have ongoing collaboration

The most active one should be MBON Pole to Pole of the Americas: ongoing data acquisition of the rocky intertidal with a common field sampling methodology. Use of new artificial intelligence methods to simplify image.